

APPARATUS FOR DISPENSING FLUID INTO OR DRAWING FLUID FROM A CONTAINER USING A SYRINGE

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 60/464,069, filed April 18, 2003, hereby incorporated by reference in its entirety as though fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] a. Field of the Invention

[0003] This invention relates to devices for dispensing fluid into and drawing fluid from a container, and more particularly, an adapter configured to engage the open top of a container, such as a test tube or cartridge, that allows a user to use a syringe, with or without an attached needle, to dispense liquid into or draw liquid from the container.

[0004] b. Background Art

[0005] An operator, such as a lab technician, attempting to carefully dispense fluids into or remove fluids from various types of containers may on occasion face certain challenges, such as an operator using a syringe to dispense blood into or withdraw blood from a test tube or other well. In such an instance, it may be necessary for the operator, during the dispensing operation, to fill the container to a certain level while assuring that the syringe does not contact the sidewalls of the container during. If the operator pays a great deal of attention to the location of the syringe within the container so as to not contact the sidewall, then the operator is in a poor position to judge to what level the liquid has filled the container. Conversely, if the operator is paying a great deal of attention to what level the fluid is reaching within the container, the operator is in a poor position to attempt to prevent contact of the syringe with the sidewall. If the syringe includes a needle attached thereto, the operator is also faced with the possibility of accidentally sticking himself with the needle while inserting it into the container.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention provides for an adapter configured to interface with a syringe and a container, having at least one fluid guide passing therethrough to allow fluid to pass between the syringe and the container. The present invention is adapted to engage the container to accurately position a dispersal point of the adapter within the container in order

to keep fluid from contacting the sidewall while dispensing fluid from the syringe into the container. The adapter can include a protrusion that can act as a visual indicator to indicate fill volume or fill level within the container. The adapter allows the user to accurately control where the fluid is placed inside the container, as well as allowing the user to accurately control the point of dispersal of the fluid from the syringe into the container in three dimensions. Moreover, the adapter helps prevent the fluid from contacting the walls of the container during dispensing. Some embodiments of the adapter are also configured to minimize the potential of a stick (prick by the needle of the syringe on the user's skin), as well as acting as a guard to protect against fluid splash back out of the top of the container.

[0007] In one aspect of the present invention, an adapter for use in dispensing or withdrawing fluid from a container using a syringe includes a main body having a rim formed at least partially around the main body and a collar extending from the main body adjacent the rim. At least one aperture is formed through the main body from an upper portion of the main body to a lower portion of the main body. The main body is adapted to be positioned on an open top of the container such that the rim at least partially engages an edge of the open top while the collar is positioned adjacent the edge and is at least partially inserted into the open top.

[0008] In another form of the present invention, a well and adapter for use with a syringe for dispensing liquid into or withdrawing liquid from the well include an opening in the well defined by an edge. The adapter has a main body with a rim formed at least partially around the main body, a collar extending from the main body adjacent the rim, and at least one aperture formed through the main body. The main body is adapted to be positioned in the opening of the well with the rim at least partially engaging the edge and the collar at least partially inserted into the opening and positioned adjacent the edge.

[0009] In yet another form of the present invention, an adapter for use in dispensing or withdrawing fluid from a container using a syringe includes a main body having a rim formed at least partially around the main body and a collar extending from the main body adjacent the rim. At least one fluid guide is formed through the main body from an upper portion of the main body to a lower portion of the main body. The at least one fluid guide is adapted to receive a portion of the syringe and the rim is adapted to at least partially engage an edge of an open top of the container while the collar is positioned adjacent the edge and is at least partially inserted into the open top.

[0010] The features, utilities, and advantages of various embodiments of the invention will be apparent from the following more particular description of embodiments of the invention as illustrated in the accompanying drawings and defined in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Fig. 1 is an isometric view of an adapter according to one embodiment of the present invention.

[0012] Fig. 2 is a right side view of the adapter shown in Fig. 1.

[0013] Fig. 3 is a top side view of the adapter shown in Fig. 2.

[0014] Fig. 4 is a front elevation view of the adapter shown in Fig. 1.

[0015] Fig. 5 is a bottom side view of the adapter shown in Fig. 4.

[0016] Fig. 6A is a detailed view of one embodiment of a terminal end structure of a tubular protrusion having an angled surface.

[0017] Fig. 6B is a detailed view of one embodiment of a terminal end structure of a tubular protrusion utilizing crisscross shapes cut across the diameter.

[0018] Fig. 7 is an isometric view of a cartridge used with the present invention.

[0019] Fig. 8 is a right side view of the cartridge shown in Fig. 7.

[0020] Fig. 9 is a front elevation view of the cartridge shown in Fig. 7.

[0021] Fig. 10 is a top side view of the cartridge shown in Fig. 9.

[0022] Fig. 11 is a bottom side view of the cartridge shown in Fig. 9.

[0023] Fig. 12A is a front side view of the adapter positioned above a gang of cartridges in a position to be inserted into one cartridge.

[0024] Fig. 12B is a right side view of the adapter positioned above the gang of cartridges in a position to be inserted into one cartridge.

[0025] Fig. 12C is a cross-sectional view of the adapter and cartridges in Fig. 12B taken along line 12C-12C.

[0026] Fig. 13A is a front side view of the adapter inserted into one of the gang of cartridges.

- [0027] Fig. 13B is a right side view of the adapter inserted into one of the gang of cartridges.
- [0028] Fig. 13C is a cross-sectional view of the adapter and cartridges in Fig. 13B taken along line 13C-13C.
- [0029] Fig. 14A is a rear side view of the adapter inserted into a single cartridge.
- [0030] Fig. 14B is a left side view of the adapter inserted into the single cartridge.
- [0031] Fig. 14C is a cross-sectional view of the adapter and cartridge in Fig. 14B taken along line 14C-14C.
- [0032] Fig. 15A is a view of a syringe without a needle inserted into the adapter of Fig. 14A.
- [0033] Fig. 15B is a view of a syringe without a needle inserted into the adapter of Fig. 14B.
- [0034] Fig. 15C is a view of a syringe without a needle inserted into the adapter of Fig. 14C.
- [0035] Fig. 16A is a view of a syringe with a needle inserted into the adapter of Fig. 14A.
- [0036] Fig. 16B is a view of a syringe with a needle inserted into the adapter of Fig. 14B.
- [0037] Fig. 16C is a view of a syringe with a needle inserted into the adapter of Fig. 14C.
- [0038] Figs. 17A and 17B illustrate a cross-sectional view of the adapter and the cartridge while dispensing fluid into the cartridge.
- [0039] Fig. 18 is an isometric view of an adapter utilizing a stick guard inserted into the cartridge.
- [0040] Fig. 19 is a right side view of the adapter and cartridge of Fig. 18.
- [0041] Fig. 20 is a front side view of the adapter and cartridge of Fig. 18.
- [0042] Fig. 21 is a top side view of the adapter and cartridge of Fig. 20.
- [0043] Fig. 22 is a bottom side view of the adapter and cartridge of Fig. 20.

- [0044] Fig. 23 is a bottom isometric view of the adapter and cartridge of Fig. 18.
- [0045] Fig. 24 is a bottom isometric view of a detached stick guard and cartridge.
- [0046] Fig. 25A is an isometric view of a second embodiment of the adapter.
- [0047] Fig. 25B is a front side view of the adapter shown in Fig. 25A.
- [0048] Fig. 25C is an isometric view of the adapter shown in Fig. 25A inserted into the cartridge.
- [0049] Fig. 26A is an isometric view of a third embodiment of the adapter.
- [0050] Fig. 26B is a front side view of the adapter shown in Fig. 26A.
- [0051] Fig. 26C is an isometric view of the adapter shown in Fig. 26A inserted into the cartridge.

DETAILED DESCRIPTION OF THE INVENTION

[0052] The present invention provides for an adapter configured to interface with a syringe and a container. The adapter has at least one aperture passing therethrough to allow fluid to pass between the syringe and the container, and engages the container so as to accurately position a fluid dispersal point of the adapter within the container in order to keep fluid from contacting the sidewall while dispensing fluid from the syringe into the container. As such, an operator using the adapter can concentrate on watching the level of fluid within the container without having to pay close attention to the location of the syringe within the container. In some embodiments of the present invention, a fluid dispersion end of the adapter may also act to provide a level indicator to allow the operator to more easily detect when the fluid level has reached the appropriate height within the container. Other embodiments of the present invention also provide protection to the operator to help prevent the operator from accidentally sticking himself with a needle connected with a syringe while using the adapter.

[0053] As previously mentioned, the adapter is configured to engage an open top of a container and includes at least one aperture extending downwardly from the top of the adapter and passing through the bottom of the adapter. When engaged with the top of the container, the bottom of the aperture opens into the container. The aperture can be sized to receive a luer end of a syringe (the small nozzle-like end of a syringe without a needle

attached thereto) to allow the use of the adapter to dispense or withdraw liquid from the container. In another embodiment, the aperture is adapted to receive a needle attached to the end of a syringe, which can be positioned in the aperture to guide the needle to a particular location within the container, as described in more detail below. The adapter can also be configured to cooperate with various features of the container to aid in positioning the adapter relative to the container. For example, in one particular embodiment, the container includes a post with a flag attached thereto extending upwardly from the top of the container. In such a configuration, the adapter may include a recess, such as a slot, adapted to receive the flag.

[0054] In use, the adapter is positioned to engage the container, and if so configured, the slot in the adapter may receive the flag structure extending from the top of the container. With the syringe engaged with the aperture opening at the top end of the adapter, the user can then either dispense the contents of the syringe into the container or withdraw the desired amount of fluid from the container, assuming the lower bottom end of the adapter is long enough or is positioned within the liquid in the container. The particular structure of several embodiments of the adapter are described below, and it is to be appreciated that the container referenced herein could be any container that has an open top, such as a cartridge, a jug, a bottle, or a well.

[0055] Figs. 1-5 show an embodiment of an adapter 50 of the present invention for use with a cartridge 52 (see, for example, Figs. 7-11 as described below), such as a test tube. The adapter 50 facilitates the use of a syringe with or without a needle to dispense liquid into or withdraw liquid from the cartridge 52. The adapter includes a main body 54 having a radially extending rim 56 with a substantially circular periphery. The rim 56 extends downward from a lower end of the main body 54. A collar 58 extends axially downwardly from the rim 56 and also has a substantially circular outer periphery. The outer diameter of the collar 58 is smaller than the outer diameter of the rim 56. A slot 60 is formed in the main body 54, which passes through the collar 58 and the rim 56 and upwardly into the main body 54 to define a first portion 62 and a second portion 64. The first portion 62 includes a straight sidewall extending along a first side 66 of the slot 60 as shown in Figs. 1 and 4. The second portion 64 includes a fluid guide 68 formed integrally therewith.

[0056] As shown in Figs. 1, 2, and 4, the fluid guide 68 includes an upper portion 70, a middle portion 72, and a lower portion 74. An aperture 76 is formed through the upper portion 70, the middle portion 72, and the lower portion 74 of the fluid guide 68. As the

aperture 76 extends from the upper portion 70 to the middle 72 and lower portion 74, the aperture size transitions from a larger diameter to a smaller diameter. As previously mentioned, in some embodiments of the present invention, the diameter of the aperture 76 in the upper portion 70 is adapted to couple with a dispensing apparatus, such as the luer termination on a syringe. As such, the aperture 76 can be tapered or otherwise shaped to snugly receive luer termination of the syringe. The aperture 76 can also be sized to receive a needle attached to the syringe. It is to be appreciated that the point of transition between the upper portion 70 of the fluid guide 68 for receiving the luer structure of the syringe and the smaller diameter middle and lower portions of the fluid guide for receiving the needle could be either higher or lower along the length of the fluid guide from that which is depicted in the figures. In one embodiment of the present invention, the aperture has a single diameter along its length for receiving only the needle portion of a syringe. The aperture can also be positioned at any location on the adapter depending on the desired location of the output of the liquid within the cartridge.

[0057] As shown in Figs. 1, 2, and 4, the middle portion 72 of the fluid guide 68 extends along the second portion 64 of the main body 54 and has a curved semicircular outer surface. More particularly, the middle portion 72 of the fluid guide 68 extends from the larger diameter upper portion 70 of the fluid guide 68 to a top surface 78 of the rim. As shown in Figs. 2-5, the aperture 76 extends through the upper portion 70 of the fluid guide 68 and partially through the main body 54 inside of a second wall 80 of the slot 60 and partially inside a curved wall 82 of the middle portion 72. From the middle portion, the aperture 76 extends axially through the lower portion or tubular protrusion 74 of the fluid guide 68. This configuration provides an efficient use of space within the adapter 50, which minimizes the amount of material used to make the adapter while at the same time includes all the important features required for its function. It is to be appreciated that the adapter can be made of virtually any type of material. For example, in one embodiment, the adapter is made of polypropylene and formed by an injection molding process.

[0058] Referring now to Figs. 1, 2, and 4, the lower portion or tubular protrusion 74 of the fluid guide 68 extends downwardly from the rim 56. The lower portion 74 can be integrally formed with the collar 58 extending downwardly from the rim, and can extend any desired distance below the rim to facilitate the dispensing of liquid from the adapter 50 at a given vertical position within the cartridge 52. The lower portion or tubular protrusion 74 of

the fluid guide 68 can also be designed with sufficient length to ensure that a bottom end 84 of the lower portion 74 is inserted into any liquid contained within the cartridge in order to withdraw the liquid from the cartridge down to the level of the bottom end of the lower portion.

[0059] The distance that the lower portion 74 extends into the cartridge is measured from a bottom surface 86 of the rim of the main body 54. As such, the rim 56 can be configured to rest on a top edge of the cartridge opening in order to provide a vertical baseline from which to measure the length of insertion of the lower portion of the fluid guide into the cartridge. As discussed in more detail below, the collar 58 can be adapted to extend into the cartridge and can be adapted to fit closely with an inner wall of the cartridge to provide some lateral support to the adapter. The collar can also include a seal, such as an O-ring, to provide a tight fit around the inner wall of the cartridge. Alternatively, the seal can be loosely fit depending on the desired application.

[0060] The shape of the rim 56 of the adapter 50 can be designed to match the shape of the opening in the cartridge 52 in order to have complete contact around the edge defining the opening in the cartridge, such as when the opening in the cartridge and the rim both have a circular shape. The rim can also be designed to be supported by the edge forming the opening of the cartridge at discrete points, for instance, if the rim has a triangular outer periphery shape and the edge defining the opening of the cartridge has a circular shape or other non-triangular shape. Likewise, the collar can be configured to closely match the shape of the inner wall of the cartridge near the opening, or can be configured to sufficiently contact the inner wall of the cartridge at discrete points in order to provide some stability of the adapter when positioned in the cartridge.

[0061] As previously discussed, the main body of the adapter in the embodiment shown in Figs. 1-5 can include the slot 60 formed therein. The slot 60 can be adapted to receive a structure, such as a post or rod, extending from the opening of the cartridge. As shown in Figs. 1, 2, and 4, the slot 60 passes through both the rim 56 and the collar 58 of the adapter 50. In other embodiments, the slot does not pass through the rim and the collar. The shape of the slot can also be different than that which is depicted in order to receive differently shaped structures extending from the cartridge. For instance, if the structure extending from the cartridge is cylindrically-shaped, the slot may also have a cylindrical shape. The structure extending from the cartridge can also be square shaped, rectangular

shaped, triangular shaped or have any shape for which the slot and the main body can be correspondingly shaped to receive when the adapter is positioned to engage the cartridge.

[0062] In the scenario where the adapter 50 is used to dispense liquid into the cartridge, and the cartridge has a fill line (or an upper and lower maximum and minimum fill line), the lower portion 74 of the fluid guide 68 can be dimensioned so as to terminate at the proper location between or at one of the extremes of one of the fill lines in order to help assist the user in determining when the liquid has been dispensed to the right level within the cartridge. While the cartridge may have scribes or marks around its circumference to indicate the proper fill level, the terminal lower end of the fluid guide provides an additional indicator of when the desired volume of liquid has been dispensed into the cartridge.

[0063] The bottom end 84 of the lower portion 74 of the fluid guide 68 can also be configured with a terminal end structure 88 to eliminate or reduce the likelihood of creating a drip when the adapter 50 is pulled out of the cartridge. As shown in Fig. 6A, one embodiment of the terminal end structure 88 can include an angled surface 90 along the longitudinal axis of the fluid guide 68, so that the fluid guide substantially terminates in a point or very sharp edge. In another embodiment shown in Fig. 6B, the terminal end structure 88 can include crisscross shapes 92 cut across the diameter or any portion of the tip.

[0064] Generally, the features of the adapter described above with reference to Figs. 1-5 include a tubular protrusion 74 extending downwardly from the main body 54 to extend into the cartridge. It is to be appreciated length of the tubular protrusion 74 may vary depending upon the particular application. For example, the tubular protrusion utilized on one embodiment of the present invention is 1.5 inches in length. The configuration of the adapter 50 allows a syringe to fluidly connect with the tubular protrusion whether or not the syringe includes a needle. If the syringe does not include a needle, the lower end (luer) of the syringe can be inserted into the top larger diameter recess of the aperture and the axial extension of the aperture in the fluid guide channels the fluid from the syringe down through the adapter and down to the terminal end of the fluid guide. In some instances, the extension of the fluid guide into the cartridge can be precisely positioned based on the desired extension and the shape of the lower portion of the fluid guide extending downwardly from the main body. The lower portion of the fluid guide extending below the main body can extend vertically downwardly at right angles to the main body, or can be connected to extend at an angle with respect thereto. The fluid guide extending below the main body can also extend

linearly as shown in the figures, or could have a curved, spiral, or angled shape. As previously mentioned, the rim extending from the base of the main body provides a locating structure for interfacing with the top of the container or cartridge, thereby accurately positioning the terminal bottom end of the fluid guide.

[0065] Figs. 7-11 show one embodiment of the cartridge 52 for which the embodiment of the adapter shown in Figs. 1-5 can be adapted to engage. The cartridge 52 is shown and described in U.S. Patent Nos. 4,599,219; 4,533,519; 4,074,971; 4,534,939, 4,663,127 and 4,752,449, which are incorporated in their entirety herein. The cartridge 52 includes a cylindrical or slightly tapered well 94 having a depth defined by the distance from an upper rim 96 to a bottom 98 of the interior of the cartridge 52. The upper rim 96 of the cartridge 52 defines an upper portion 98 of the well 94 in which the adapter 50 fits or is received. As shown in Figs. 7-9, the cartridge 52 may also include a fill line, or a minimum 100 and maximum fill line 102 positioned thereon. Either fill line may be defined by a scribe on the outer surface of the cartridge 52. The cartridge can also be formed in a "gang" of two or more cartridges attached together. A plate 104 forms the top surface of the gang of cartridges, and the well of each cartridge extends downwardly from the plate. As such, the plate 104 forms the upper rim 96 of the cartridge 52. The plate 104 can also be scored between the two cartridges to allow the cartridges to be separated if desired by pulling the plate apart along a score-line 106. The plate as shown in Figs. 7-9 defines a generally rectangular shape with rounded corners and extends outwardly in a generally perpendicular direction away from the cartridge wells 94. As shown in Figs. 7 and 8, the plate 104 extends more in one direction away from the cartridges so as to define an extended portion 108. The extended portion 108 of the plate 104 defines a U-shaped recess 110 in a perimeter edge, which is centered upon the score-line 106.

[0066] Figs. 12A-12C show the adapter 50 above the gang of cartridges 52 in a position to be inserted into one cartridge, and Figs. 13A-13C show the adapter 50 inserted into one of the gang of cartridges 52. The rim 56 of the adapter 50 engages the top of the plate 104 of the cartridge 52, and the collar 58 fits inside the top opening of the cartridge well 94. A post structure 112 extending upwardly out of the cartridge well 94 having a flag 114 connected therewith is adapted to be received within the slot 60 formed in the main body 54 of the adapter 50. In the cartridge illustrated, the post structure 112 has a bottom end portion 116 engaged with a diaphragm 118 forming a bottom wall 120 of the cartridge. Sidewalls

122 of the cartridge extend downwardly below the diaphragm 118 and form an open bottom end 124. Any liquid dispensed into the well 94 from the top collects on the bottom wall 120 of the cartridge formed by the diaphragm 118, and fill the cartridge from the diaphragm up. The collar 58 and the rim 56 of the adapter 50 engaging with the upper portion 98 of the cartridge well 94 and the plate 104 provides stability for positioning the adapter in the open top of the cartridge. The tubular protrusion 74 extends from the main body 54 down into the cartridge 52. The bottom end 84 of the tubular protrusion 74 is positioned next to the sidewall 122 of the cartridge 52 so that any fluid being dispensed therefrom falls to the bottom of the well without contacting the post structure and with reduced contact with the sidewall. The tubular protrusion 74 extends downwardly into the cartridge any desired distance. As shown in Fig. 13C, the tubular protrusion 74 terminates at or near the top fill line 102 marked on the sidewall 122 of the cartridge 52.

[0067] Figs. 14A-14C show the adapter 50 inserted into a cartridge 52 that is either separated from a gang of cartridges or constructed as a single cartridge. Figs. 15A-15C show the adapter of Figs. 14A-14C with a luer 126 of a syringe 128 positioned in the top, larger, recess of the fluid guide 68. No needle is attached to the syringe. Any liquid flowing from a reservoir 130 in the syringe 128 above the luer 126 would flow through the luer end, into the aperture 76 formed in the fluid guide 68, and down into the cartridge well 94. Figs. 16A-16C show the adapter 50 of Figs. 14A-14C with a luer 126 and needle 132 of the syringe 128 positioned in the aperture 76 of the fluid guide 68. Any liquid flowing from the reservoir 130 in the syringe 128 above the luer 126 would flow through the luer end, into the needle 132, through the needle 132, and into the cartridge well 94. As shown Fig. 16C, the needle extends out from the bottom end of the tubular protrusion. In other embodiments, the needle is configured to terminate at the bottom end of the tubular protrusion or at some point within the tubular protrusion.

[0068] Figs. 17A-17B illustrate the dispensing of fluid 134 into the cartridge 52 from the syringe 128 having the luer end 126 only using the adapter 50 shown in Figs. 1-5. The syringe 128 is shown with the luer end inserted into the larger diameter upper portion 70 of the fluid guide 68. The fluid 134 in the syringe 128 then flows out of the syringe, through the luer 126, into the fluid guide 68, and down into the cartridge well 94. The fluid is shown collecting on top of the diaphragm 118. In Fig. 17B, the fluid 134 in the syringe 128 has mostly been dispensed into the cartridge 52 and the fluid level has risen to near the upper

fluid fill level 102. Once dispensing is stopped, the syringe can be removed from the adapter and the adapter can be removed from the cartridge. While removing the adapter from the cartridge, depending on the particular use of the invention, care must be taken to minimize any movement of fluid up the sidewall of the cartridge, or up the post structure.

[0069] Embodiments of the present invention may also include a stick guard 136 to help prevent accidental pricks by the needle connected with the syringe as the user inserts the needle into the adapter. The stick guard 136 can extend from the main body 54 of the adapter 50 above the rim 56, and may or may not be structurally associated with the rim. The stick guard can have any desired shape, such as the ovalized rectangle shape shown in Figs. 18-23.

[0070] In the embodiment shown in Figs. 18-23, the stick guard 136 does not extend over the upper rim 96 of the adjacent cartridge 52. The stick guard 136 extends outwardly from the main body 54 of the adapter 50 in all directions and defines a generally oval shape. It is to be appreciated that the shape of the stick guard 136 is not limited to that which is depicted herein. For example, the stick guard can be flat, curved, convex, concave, or any combination thereof depending on the particular design of the adapter. As previously mentioned, the stick guard protects a user from the sharp end of the needle when the operator is inserting the needle into the adapter. If the needle slips while being inserted into the adapter, it is more likely that the needle will contact the stick guard as opposed to the operator's hand positioned below the stick guard. The stick guard 136 can be an extension of the rim 56 of the main body 54 of the adapter 50, or the stick guard can be an extension from the main body but not from the rim, such as extending outwardly from the main body above the rim. In other embodiments, the plate 104 of the cartridge(s) can function as a stick guard, and can have different shapes to facilitate that function. The stick guard 136 could also be a separate piece of material not attached permanently to either the adapter 50 or to the cartridge 52, as shown in Fig. 24.

[0071] The stick guard may also include an orienting structure 138 extending downwardly from the stick guard 136 in order to restrict the orientation of the adapter 50 with respect to the cartridge 52. The orientation structure 138 shown in Figs. 18-23 illustrate how the structure can be used to make sure the adapter 50 is positioned in the cartridge 52 with the desired orientation. The desired orientation can be important where the tubular protrusion 74 of the adapter 50 needs to be positioned with particularity relative to the cartridge, or with the post structure 112 in the cartridge 52. The orientation might also be important to insure that

the structure extending above the cartridge is properly received in the slot or other recess formed in the main body of the adapter. As shown in Figs. 18-23, the orientation structure keys off of the perimeter features of the plate 104 extending around from the top of the cartridge(s) 52. Three tabs are shown extending from the stick guard 136, generally, the tabs extend downwardly opposite the open top of the cartridge. The tabs are positioned such that a first tab 140 fits into the U-shaped recess 110 on the periphery of the plate 104, a second tab 142 is positioned to engage the plate 104 opposite the first tab 140 and generally opposite the adjacent cartridge 52 if the cartridges are ganged together, and a third tab 144 is positioned to engage the side of the plate 104 extending parallel to the side-by-side adjacent orientation of the two cartridges. With three tabs, three sides of the plate need to be contacted to create an orientation function. One tab, two tabs or more than three tabs could be used, depending on their location on the stick guard, but three tabs provide an efficient and certain orientation structure.

[0072] As shown in Figs. 18-24, the first tab 140 and the second tab 142 are curved so that when either tab is inserted into the U-shaped recess 110 of the plate 104, it engages a curved portion of the U-shape. Both the first 140 and second tabs 142 are curved because when the adapter is used in the adjacent cartridge of Fig. 18-24, the second tab 142 will be positioned in the U-shaped recess 110. The third tab 144 is flat to engage the linear edge of the plate 104 against which it rests. The thickness of the third tab 144 can be configured to change from relatively wide at a connection 146 to the underside of the stick guard to relatively thin at a distal end 148. This gradual change in thickness can also help pull the first and second tabs into a tight fit with the periphery of the plate and thus more purposefully position and orient the adapter for the cartridge.

[0073] In other embodiments of the present invention where the lower portion of the fluid guide has sufficient length such that the needle does not protrude from the bottom end, the need for a stick guard may be eliminated. In such a configuration, the lower portion of the fluid guide can be dimensioned so as to be relatively flexible and/or the lower portion can be made of material which provides additional flexibility. As such, if the needle is engaged with the adapter before insertion into the cartridge, a slip by an operator might result in the lower portion of the fluid guide harmlessly impinging on the operator's hand as opposed to the sharp tip of the needle.

[0074] Figs. 25A-25C show a second embodiment of the adapter 50'. In the second embodiment, the adapter 50' includes a main body 54' as described with respect to the adapter shown in Figs. 1-5, but does not include the tubular protrusion 74 extending downwardly from the main body 54 into the cartridge, nor does the second embodiment include the larger diameter upper portion 70 of the fluid guide 68 adapted to function as the luer connection. The fluid guide 68' is formed along the second portion 64' of the main body 54' and extends from the top of the main body to the bottom of the main body. The fluid guide 68' is a cylindrical void or aperture 76' and has a diameter sufficient for receiving a needle connected with a syringe. The diameter of the aperture 76' can be the same along its length or can vary along its length. As with the previous embodiment and as shown in Fig. 25C, the adapter 50' is received in the top of the cartridge 52 so that the rim 56' of the adapter contacts the upper rim 96 of the cartridge 52 and the collar 58' extends into the cartridge in order to provide some stability to the adapter 50'. The operator can use the syringe with the needle to dispense or withdraw liquid from the cartridge. As such, the operator can insert the needle into the aperture of the fluid guide, which in turn, would guide the needle into to a proper location near the top of the cartridge in order to dispense fluid from the needle through the adapter and into the cartridge well. The second embodiment of the adapter 50' shown in Figs. 25A-25C can also be provided with a stick protector, which can also be provided with the orientation structure described above. The main body 54' in the second embodiment of the adapter 50' can also be formed to receive any shape of structure extending from the top of the cartridge, as needed, and as described above.

[0075] Figs. 26A-26C show a third embodiment of the adapter 50" of the present invention. In the third embodiment, similarly with the previous two embodiments, a main body 54" includes a rim 56", a collar 58", and a slot 60" for receiving the structure protruding from the cartridge. Again, the slot 60" can be of any shape to receive any particular shape of any projection from the cartridge 50". In the third embodiment, a first fluid guide 150 and a second fluid guide 152 are formed on either side of the main body 54", with the first fluid guide 150 being longer than the second fluid guide 152. The longer first fluid guide 150 is configured to facilitate the use of the syringe 128 with a relatively long needle, while the shorter fluid guide is configured to facilitate the use of the syringe with a shorter needle. As with the fluid guides described above, the lengths of the fluid guides can be configured such that the needles terminate with the end of the fluid guide, within the fluid guide, or can

extend beyond the bottom of the fluid guide. Each fluid guide defines a cylindrical aperture 76" or tube extending therethrough which has a dimension sufficient to receive the needles, such dimension can be consistent along its length or can vary as desired. Fig. 26C illustrates the syringe 128 in engagement with the second fluid guide 152. The third embodiment of the adapter 50" shown in Figs. 26A-26C can also be provided with the stick protector, which can also be provided with the orientation structure described above.

[0076] It will be appreciated from the above noted description of various arrangements and embodiments of the present invention that an adapter configured to engage a syringe and a container to facilitate fluid passage from the syringe to the container or from the container to the syringe provides several functions. For example, the adapter provides a means to deliver the contents of the syringe into a container or well via the fluid guide defined by an aperture. The adapter also allows an operator to withdraw the contents of a well or container into a syringe via a defined pathway. Needle access can also be provided to an internal chamber of the container so that the needle does not come into contact with the walls of the chamber. The adapter also acts to provide protection against splash back and/or spillage of fluid when dispensing into or withdrawing from the container. Moreover, the adapter allows an operator to insert or withdraw the liquid from the container at a precise location within the container both vertically and within the plane of the terminal end of the fluid guide, such as offset from the center of the container as shown in Figs. 17A and 17B. Embodiments of the adapter can be structured so as to provide a sealed engagement with the top of the cartridge, such as by using an O-ring or some other sealing structure such as a pliable surface coating, or can be configured to allow the container or well to vent by not sealing the adapter to the cartridge.

[0077] The adapter can be used and formed in various ways with various types of containers depending upon the specific application. For example, the adapter can be used to withdraw blood from or dispense blood into a well or container, to prevent a hazardous fluid from splashing back into contact with the operator during the dispensing operation, or to prevent debris from entering the well or container during the fluid dispensing or withdrawing operation. It will be appreciated that the features described in connection with each arrangement and embodiment of the invention are interchangeable to some degree so that many variations beyond those specifically described are possible. For example, the third

embodiment of the adapter shown in Figs. 26A-26C can be configured with tubular protrusions extending from the main body of the adapter.

[0078] Although various embodiments of this invention have been described above with a certain degree of particularity or with reference to one or more individual embodiments, those skilled in the art could make numerous alterations to those disclosed embodiments without departing from the spirit or scope of this invention. It is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative only of particular embodiments, and not limiting. Changes in detail or structure may be made without departing from the basic elements of the invention as defined in the following claims.